

Full Length Research Paper

Prevalence of Hiv/Aids and Pulmonary Tuberculosis Co-Infection among Patients Attending Some Health Centres of Bauchi Metropolis

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Abstract

The global impact of the converging dual epidemic of pulmonary tuberculosis (PTB) and Human immunodeficiency virus (HIV) is one of our major public health challenges. In this study, a total of 262 confirmed HIV positive patients were screened for co-infection with the PTB. They consist of 147 males and 115 females, with an age range from 1 to 60 years and above, hailed mainly from urban (119) and semi-urban (78) settings, mainly civil servants (61) and traders (52). Out of the HIV patients tested for PTB, 7.3% were smear-positive (co-infected) with highest prevalence 13.7% found among the age group of 31 to 40 years, males (8.2%). The HIV prevalence of 12.3% was in PTB negative patients, females (16.5%) with high rate 17.8% in 21 to 30 years group. HIV negative/PTB positive frequency of 11.6% was observed among the males. Prevalence of HIV/PTB co-infection (11.5%) was in the traders/artisans, then drivers (8.8%) with rates of (15.4%) and (19.6%) respectively for HIV only. In the control group, the highest prevalence of PTB (19.6%) was also among the traders/artisans, but followed by farmers (15.4%). Most of the patients are from urban settings, with HIV/PTB (7.6%) and HIV cases alone (13.4%), while PTB cases were more prevalent (21.5%) in those from rural areas. Patients' clinical profile shows that prevalence of HIV/PTB co-infection (15.5%) and HIV alone (27.3%) was within patients not on HAART. A similar rate 9.4% and 12.3% were also found among patients not on TB treatment, with the co-infection also higher 12.3% in those with low CD4 cells count. The rate of HIV/PTB co-infection in our study is generally lower than the single occurrence and is associated with delayed therapy which predisposes the patients with immunosuppression.

Keywords: Pulmonary tuberculosis (PTB), Human immunodeficiency virus (HIV), highly active antiretroviral therapy (HAART), immunosuppression, traders/artisans, civil servants, farmers.

INTRODUCTION

Human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) and Tuberculosis (TB) co-infection is the existence of these two diseases

entities together in a particular patient at the same time. Tuberculosis (TB) represents the most serious opportunistic infection in HIV infected patients and a leading cause of death in HIV infected patients (Lynn, 2012; Ojiezeh *et al.*, 2015). HIV co-infection is the most powerful known risk factor for progression of *M. tuberculosis* infection to active disease, increasing the risk of latent TB reactivation 20-fold. Likewise, TB has

been reported to exacerbate HIV infection (Dosekun and Fox, (2010).

Tuberculosis (TB) is the most common serious opportunistic infection in HIV positive patients and is the manifestation of AIDS in more than 50% of cases in developing countries (Beyrer *et al.*, 2012). TB can occur at any time during the course of HIV infection. The directly observed treatment short course (DOTS) strategy adopted by TB control programs in the majority of countries has not been sufficient to control HIV associated TB, particularly in Sub-Sahara Africa, as a result of the unprecedented increase in TB case load (Modjarrad and Vermund, 2010). Although the global incidence of TB has taken a downward trend in recent years, the incidence has increased in Sub-Sahara Africa in areas of high HIV prevalence. As a result, there are currently more new TB cases each year than ever before (Okoh and Omuemu, 2012).

The emergence of human immunodeficiency virus (HIV) has paved the way for the resurgence of *Mycobacterium tuberculosis* infection. HIV is the most powerful risk factor for the progression of pulmonary tuberculosis (PTB). Tuberculosis (TB) accelerates the progression of HIV infection to AIDS and shortens the survivals of such patients. The two are intricately linked to malnutrition, unemployment, poverty, drug abuse and alcoholism (Getahun *et al.*, 2010). HIV is known to increase the risk of reaction in people with latent tuberculosis and also increase the risk of subsequent episodes of PTB from exogenous re-infection. It has also corroborated by noting that HIV patient is highly vulnerable to PTB because of their weakened immune system and the latter is now their number one killer. Surveillance of HIV among PTB patient has been recognized as important as the HIV epidemic continues to fuel TB epidemics (Sharma *et al.*, 2005). In many countries, HIV prevalence among PTB patient is a sensitive indicator of the spread of HIV into the general population (Lawn and Churchyard, 2009).

The interaction between tuberculosis (TB) and human immunodeficiency virus (HIV) infection is complex. In the individual patient, HIV infection weakens the immune system and increases the susceptibility to TB. HIV increases the likelihood of reactivation, re-infection and progression of latent TB infection to active disease. It also alters the clinical presentation of TB, complicates the follow up and compromises the response to anti-TB treatment (Datikoet *et al.*, 2008). The lifetime risk of developing active TB once infected, in absence of HIV infection, is about 10% in a population (Harries and Dye, 2006). However, it increases tenfold in HIV infected individuals. This has resulted in a large increase in the number of TB cases (Tsaku *et al.*, 2011).

The largest increase in tuberculosis has occurred in locations and demographic groups with the highest HIV prevalence, which suggests that the epidemic of HIV is at least partially responsible for the increase of tuberculosis

(Padyana *et al.*, 2012). There is evidence that immune responses in tuberculosis and in other infection induce cytokines that enhance the replication of HIV and this drives the patient into a full picture of AIDS (Tsaku *et al.*, 2011). In the individual host the two pathogens, *M. tuberculosis* and HIV, potentiate one another, accelerating the deterioration of immunological functions and resulting in premature death if untreated. Some 14 million individuals worldwide are estimated to be dually infected (Lawson *et al.*, 2008). TB is the largest single cause of death in the setting of AIDS accounting for about 26% of AIDS-related deaths, 99% of which occur in developing countries (May and Ingle, 2011; Beyrer *et al.*, 2012).

The global resurgence of TB has been fueled by a combination of factors, including increasing rates of HIV/AIDS and multidrug resistance, inadequate investments in public health infrastructure, insufficient political commitment, limited awareness of TB, disparities in access to and quality of health care services, and inadequate investments in new tools, including drugs, diagnostics, and vaccines. The disease threatens the poorest and most marginalized, disrupts the social fabric of society, and slows or undermines gains in economic development (Lynn *et al.*, 2012).

It is estimated that one-third of 40million people living with HIV/AIDS worldwide are co-infected with tuberculosis (TB), people with HIV are up to 50 times more likely to develop Tuberculosis in a given year than HIV-negative people (Okoh and Omuemu, 2012). The epidemic has completely destabilized tuberculosis control in high HIV prevalence region. Today 50% or more of new TB cases are also HIV co-infected in Africa, which is the center of the HIV/TB epidemic, Nigeria has an estimated incidence of nearly 300,000 cases of all TB-burden country in the world; recorded HIV prevalence among TB patients rose from 2.2% to 17% from 1991 to 2000 (Lawson *et al.*, 2008).

In Nigeria, an estimated 3.6 percent of the population is living with HIV and AIDS. Although, HIV prevalence (3.1%) is much lower in Nigeria than in other countries such as South Africa and Zambia, the size of Nigeria's population meant that by the end of 2009, there were almost 3million people living with HIV (Onubogu *et al.*, 2010). In addition, Nigeria has one of the highest TB burdens in the world, resulting in the largest burden in Africa (WHO/UNAIDS, 1999)

In developing countries like Nigeria, many HIV infected people require antiretroviral therapy and the need is more among TB patients co-infected with HIV (Nwabuko *et al.*, 2012; Ojiezeh *et al.*, 2015). Therefore, knowledge about the rate of HIV infection in TB patients might help in planning, understanding the spread of the dual infections and monitoring the performances of TB and HIV control activities. Therefore, this study was aimed to determine the prevalence of HIV and TB co-infection among sero-

positive patients.

MATERIALS AND METHODS

Subjects and selection criteria

A hospital for the study subjects' enrollment was selected based on their capacity to diagnose HIV, tuberculosis, administer ART and treat TB patients. The diagnostic services included routine retroviral screening tests, direct sputum microscopy and chest x-rays. All TB patients were consecutively enrolled at their visit to the treatment unit of the hospital, with their informed consent. The diagnosis of TB was based on the recommendations of WHO (2008). Patients presenting with symptoms suggestive of TB who had a productive cough for three weeks or more with at least two positive sputum smears (by Ziehl-Nelsen or Auramine staining technique) or one positive smear and x-ray findings consistent with active TB were classified as smear-positive TB cases.

The HIV-positive patients involved in the study are recommended for antiretroviral therapy (ART) or already on the treatment. Patients that are confirmed HIV-negative are also screened for TB as control subjects. Patients' personal data information sheet was used to collect their socio-demographic details (age, sex, occupation, education level and marital status), with approval from the ethics committee of the Infectious diseases hospital, Bayara, Bauchi state, Nigeria.

Sample collection

This was carried out according to standard laboratory techniques described by Harries *et al.* (2004); Mandell *et al.*, (2010). A total of 508 blood and sputum samples was collected from HIV-positive patients, while 58 sputum samples were also collected from patients with HIV-negative status. A sterile syringe was used to collect 5ml of venous blood, or lancet, to deliver a drop of blood and clean wide-mouth bottle was given to the patient to cough deeply to produce early morning sputum.

Sample processing

i). HIV screening/confirmatory test

Determined HIV1/2 rapid immunochromatographic test strip was used to screen the blood samples and confirm the sero-positive patients as described by Cheesbrough (2012). In the test, collected blood sample (whole blood) was placed on the sample application pad; one drop of buffer (supplied with the kit) was added. The test result was read after 15 minutes, a positive HIV antibody test result is shown by a pink line in the patient test area and a pink line in the control area. The presence of the pink

line in the control area only indicates a negative HIV antibody test and shows that the reagent has performed satisfactorily (Cheesbrough, 2012).

(ii) Tuberculosis screening test

Microscopic examination of the sputum samples for Acid Fast Bacilli (AFB) was carried out using Ziehl-Nelsen (ZN) and Auramine staining techniques as described by Forbes *et al.* (2002); Harries *et al.* (2004). The smears were examined under ordinary light microscope, where AFB appear as straight/slightly curved rods and under a fluorescence microscope, it appears glowing yellow against the dark field background.

RESULTS

In this study, a total of 262 confirmed HIV positive patients were screened for co-infection with pulmonary tuberculosis (PTB). They consists of 147 males and 115 females, with an age range from 1 to 60 years and above, hailed mainly from urban (119) and semi-urban (78) settings, occupying the various socioeconomic status, mainly civil servants (61) and traders (52). Out of the HIV patients tested for PTB, 7.3% (19 of 262) were smear-positive (co-infected) with highest prevalence 13.7% (7 of 51) found among the age group of 31 to 40 years, and males (8.2%). The HIV prevalence of 12.3% (32 of 262) was found in PTB negative patients, with high rate 17.8% (13 of 73) among 21 to 30 years group and female gender (16.5%).

HIV negative/PTB positive frequency of 11.1% (28 of 262) was also observed with the highest rate of 37.5% (9 of 24) obtained among the elderly (60 years and above) and males (11.6%). Occupational profile of the subjects shows a higher prevalence of HIV/PTB co-infection (11.5%) among the traders/artisans, followed by drivers (8.8%). These two groups have rates of 08(15.4%) and 09(19.6%) respectively for HIV only. In the control group (HIV negative patients), the highest prevalence of PTB (19.6%) was found among the traders/artisans group, followed by farmers (15.4%). Most of the patients in this study are from urban and semi-urban settings, with HIV/PTB 7.6% (urban), 7.5% (semi-urban). HIV cases alone were mainly found in patients from urban centres (13.4%), while PTB cases were more prevalent (21.5%) among those from rural areas.

Patients' clinical profile in this study (table 2), shows that 178 were receiving highly active antiretroviral treatment (HAART) and 84 are not. The highest prevalence of HIV/PTB co-infection 15.5% (13 of 84) and HIV alone 27.3% (23 of 84) were found among patients not on HAART, with low prevalence of 3.4% (6 of 178) and 5.1% (9 of 178) respectively among those on the treatment. In this study, 145 of the PTB patients on direct

Table1. Prevalence of HIV/AIDS and PTB co-infection according to patients' demographic profile

| Demographic Profile | No. of Patient | | No. (%) of Patient Positive/Negative | | |
|---------------------|-------------------|------------------------|--------------------------------------|-------------------------------------|--|
| | Screened n=262 | HIV+ve/TB+ve (n=19) | HIV+ve/TB-ve (n=32) | HIV-ve/TB+ve (control) (n=28) | |
| Age(years) | | | | | |
| 1-10 | 04 | 00(0.0) | 00(0.0) | 00(0.0) | |
| 11-20 | 42 | 03(7.1) | 06(14.3) | 02(4.8) | |
| 21-30 | 73 | 05(6.8) | 13(17.8) | 01(1.4) | |
| 31-40 | 51 | 07(13.7) | 07(13.7) | 08(15.7) | |
| 41-50 | 32 | 01(3.1) | 03(9.4) | 03(9.4) | |
| 51-60 | 36 | 02(5.6) | 01(2.7) | 05(13.9) | |
| >60 | | | | | |
| Total | 262 | 19(7.3) | 32(12.3) | 28(11.1) | |
| Sex/Gender | | | | | |
| Male | 147 | 12(8.2) | 13(8.8) | 17(11.6) | |
| Female | 115 | 07(6.1) | 19(16.5) | 11(9.6) | |
| Occupation | | | | | |
| Civil Servant | 61 | 03(4.9) | 06(11.5) | 05(5.4) | |
| Trader/Artisan | 52 | 06(11.5) | 08(15.4) | 09(19.6) | |
| Driver | 46 | 04(8.8) | 09(19.6) | 07(13.5) | |
| Farmer | 39 | 03(7.8) | 04(10.3) | 06(15.4) | |
| Student | 43 | 02(4.7) | 02(4.7) | 00(0.0) | |
| House wife | 21 | 01(4.8) | 03(14.3) | 01(4.8) | |
| Location | | | | | |
| Urban | 119 | 09(7.6) | 16(3.4) | 06(5.0) | |
| Semi-urban | 78 | 06(7.5) | 07(8.9) | 08(10.3) | |
| Rural | 65 | 04(6.2) | 04(6.2) | 14(21.5) | |

Table 2. Prevalence of HIV/AIDS and PTB co-infection according to patients' clinical profile

| Clinical Profile | No. of Patient | | No. (%) of Patient Positive/Negative | | |
|-------------------|-------------------|------------------------|--------------------------------------|-------------------------------------|--|
| | Screened n=262 | HIV+ve/TB+ve (n=19) | HIV+ve/TB-ve (n=32) | HIV-ve/TB+ve (control) (n=28) | |
| HAART | | | | | |
| Yes | 178 | 06(34) | 09(5.1) | N.A | |
| No | 84 | 13(15.5) | 23(27.3) | N.A | |
| DOT | | | | | |
| Yes | 145 | 08(5.5) | 00(0.0) | 21(14.5) | |
| No | 117 | 11(9.4) | 32(12.3) | 07(6.0) | |
| CD4+ Count | | | | | |
| Normal | 153 | 05(3.3) | 25(16.3) | N.A | |
| Low | 109 | 14(12.8) | 07(6.4) | N.A | |

Key: N.A = Not applicable

HAART = highly active antiretroviral retroviral therapy

DOT = Direct observed therapy

CD4 = Clusters of differentiation

observed therapy (DOT), while 117 were not. The prevalence of HIV/PTB co-infection 9.4% (11 of 117) and HIV alone 12.3% (32 of 117) were found among patients not on DOT, with low prevalence of 5.5% (8 of 145) and 0.0% (0 of 145) respectively among those on the TB

treatment. HIV/PTB co-infection was higher 12.3% (14 of 109) among patients with a low CD4 cells count than those with normal 3.3% (5 of 153). But the prevalence of HIV alone was higher 16.3% (25 of 153) among those normal CD4 count.

DISCUSSION

Co-infection with HIV leads to challenges in both the diagnosis and treatment of tuberculosis (Nwabuko *et al.*, 2012). TB is the most common opportunistic infection among HIV-infected individuals, and co-infected individuals are at high risk of death (Berhe *et al.*, 2012). An estimated 11-13 percent of incident cases were HIV-positive TB may occur at any stage of HIV disease and is frequently the first recognized presentation of underlying HIV infection (Sharma *et al.*, 2005; Pennap *et al.*, 2010). As compared to people without HIV, people living with HIV (PLWH) have a 20-fold higher risk of developing TB and the risk continues to increase as CD4 cell counts progressively decline (Erhabor *et al.*, 2010). Reports show that active tuberculosis increases the morbidity and fatality of HIV-infected person and about one-third die of tuberculosis (Beyrer *et al.*, 2012).

In the present study, out of the 262 HIV patients tested for PTB (table 1), 9 (7.3%) is co-infected, with highest prevalence 13.7% (7 of 51) found among the age group of 31 to 40 years, and males (8.2%). These results are consistent with the findings of Odaibo *et al.* (2013) where the rate was highest (16.9%) among 30 - 39 years age group, and the rate of HIV/TB co-infection was consistently higher among more female (15.5%) than in males (9.5%) over the 3 year period of their study.

Tadesse and Tadesse (2013) reported the prevalence of HIV co-infection 97 (11.4%) among females and within 15-39 age group in Dabat, Ethiopia, which are described as the socio-economically active group of the population. The high prevalence of HIV co-infection among TB patients observed among younger age group in this study is consistent with the findings of other studies (Pennap *et al.*, 2010; Kamenju *et al.*, 2011). This age prevalence of HIV co-infection among TB patients probably reflects the age-specific prevalence of HIV in the community. This may be related to patients' being in a sexually active age group in which both TB and HIV prevail most (Tessema *et al.*, 2009; Berheet *et al.*, 2012).

Potororing *et al.* (2010) reported a higher rate of HIV infection in female TB patients than males in India and Indonesia respectively. This shift is an indication that women are now more at risk of acquiring HIV infection than men in Nigeria. This rising trend in female HIV prevalence is not unexpected due to the fact that the penile-vaginal transmission by an infected individual in a single sexual exposure is as low as one in 1000 from woman to man and as high as one in 300 from man to woman (Isiramem, 2003). In addition, the poor economic status and the pressure on women to provide for their families as well as the lack of ability to negotiate safer sex with Nigeria women (Kirby *et al.* 2007; Iliyasu and Babashani, 2009; Anderson, 2012) may have contributed to increasing the risk of women of acquiring HIV infection.

Previous studies demonstrated predominantly in young

adults averaging 33 years of age (Nwabuko *et al.*, 2012). The prevalence of HIV/PTB among the men is also a reflection of socioeconomic status, especially among men, who frequently migrate while searching for better jobs, and are in contact with more people, thus increasing the probability of exposure. Males in advanced age, singles and low socioeconomic status were all positively correlated with the risk of developing active TB. Many studies reported that (male) gender is a high risk factor for developing active TB (Berheet *et al.*, 2012). In addition, there are more men with registered cases of TB without HIV, at a ratio of 2:1 men to women (Sawant *et al.*, 2011).

The predominance in males could be due to the lack of official records for women, due to differences in social behavior or to poor public health services (Anderson, 2012). While the prevalence of HIV infection among TB patients also varies from country to country, the highest rates have been reported in areas where HIV prevalence is high in the general population. For example a high co-infection rate of 44% - 52% has been reported in Kenya (Erhaboret *et al.*, 2010). High prevalence of PTB positive among the elderly males (11.6%) in this study could be attributed to weaken the immune system due to increased age (Berhe *et al.*, 2012).

The highest prevalence of HIV/PTB co-infection (11.5%) among the traders/artisans and drivers (8.8%) may be due to various occupational hazards associated with their lives as reported in previous studies (Iliyasu and Babashani, 2009; Pennap *et al.*, 2010). A study conducted among gold miners in South Africa showed that the risk of TB doubles within one year of HIV infection, but only increases slightly during the following years (Getahun *et al.*, 2010). It has been noted that pulmonary TB occurs relatively early in the spectrum of HIV related infections and often before other AIDS-defining conditions (Lawn and Churchyard, 2009).

HIV prevalence is higher in urban centres (13.4%) could be due to people life style and related risk factors. The PTB prevalence (21.5%) among those from rural areas was linked to agricultural activities and low awareness (Pennap *et al.*, 2010; Tadesse and Tadesse, 2013). The higher rate of HIV infection in TB patients from urban, 25% than rural areas 16% was also reported by Datiko *et al.*, (2008).

In our study, the prevalence of HIV/PTB co-infection 15.5% and HIV alone 27.3% were higher among patients not receiving antiretroviral therapy (ART) and TB treatment (table 2). Although ART can reduce the incidence of TB both at the individual and population level, HIV patients on ART still have higher TB incidence rates and a higher risk of mortality. This may be due to delayed initiation of ART or the fact that patients present with advanced TB or both (Berhe *et al.*, 2012).

The higher HIV/PTB co-infection among patients with low CD4 cells count in our study is related to other findings in previous studies (Nwabuko *et al.*, 2012;

Padyana *et al.*, 2012), which show a significant relationship between immunosuppression and AIDS-defining syndromes. The increase in the risk of developing PTB soon after being infected with HIV might be due to the risk associated with sero-conversion illness or of being co-infected. As a result, individuals infected with HIV have increased susceptibility to active tuberculosis.

CONCLUSION

In this study, the prevalence of HIV/PTB was highest among the young to middle active age group. This difference in the most affected age group further reflects the role of HIV infection as an important factor in the acquisition of PTB in this area. The study showed that of HIV infected persons without ART had the highest tuberculosis co-infection. More strategic preventive measures that enhance body immunity among HIV patients are highly needed as early as possible before they develop active tuberculosis. Routine screenings for PTB among HIV patients will help to identify those without the disease prevent and promptly treat it.

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